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THE JOURNAL OF PHILOSOPHY

RELATIVITY AND THE LAY MIND. I

THE doctrine of relativity is said by physicists to have revolutionized their conception of the physical world. Laymen in physics, while both unable to follow and willing to trust the recondite observations and far-flung reasoning which have led to the doctrine, may yet expect to learn what it means, and claim to criticize its presuppositions, and the inferences which physicists have drawn from it. The creed of relativity is theirs to understand, and the basis of the creed, with the arguments founded on it, to accept or reject. Moreover, since laymen in physics make up the vast majority of the race, until laymen do understand what relativity means, and accept its premisses and its conclusions, the doctrine will not have conquered mankind. Relativity will not have effected a revolution in general human thought about the physical world, but only a revolution in the intimate thought of a vanishingly small *élite* of humanity.

An understanding of what relativity means is still far from general among laymen in physics. At a symposium of philosophers in 1926, devoted to the doctrine, the point first dwelt upon by a critic was its unintelligibility to the tyro in symbols. "The very worst lecture I ever heard" was the comment of a well-known psychologist upon one of a popular course on relativity lately given by a mathematician. Mr. Wells, in *William Clissold,* also dated 1926, voices the hopelessness of the layman (p. 55). "In the depths, or heights, of physics, for one word seems as good as another when all sense of direction is lost, I find my mind sitting down at last exhausted of effort, in much the mood of Albrecht Dürer's *Melencolia.*"

The following essay aims to develop some of the difficulties likely to be encountered by a layman at the threshold of an attempt to understand what relativity means, and to study some of its presuppositions, and some of the conclusions currently drawn from the doctrine. Conspicuous among its expositors to English readers are Professor Arthur S. Eddington and Mr. Bertrand Russell. Professor Eddington's book *Space, Time and Gravitation,* was first published in 1920. His Romanes Lecture, *The Theory of Relativity and Its Influence on Scientific Thought,* followed in 1922. Mr. Russell's book *The A. B. C. of Relativity* appeared in 1925. All three of

these sources, and no others, will be drawn upon in the following discussion. All are addressed to the "general reader," although most laymen would certainly disclaim the physical knowledge and mathematical grasp demanded for any thorough assimilation of Professor Eddington's book; while Mr. Russell's book sometimes informs simply without directly elucidating.

1. Motion

A statement like Mr. Russell's (*A. B. C.*, p. 10)—"All motion is relative"—may offer a layman his first difficulty with these expositions. It is to be recalled that relativity is a doctrine of physics, and when "motion" is spoken of, it is spatial motion that is meant, and not, for example, what is called *e-motion*. When a layman speaks of motion, meaning motion in space, he is apt to think of it as something inherent in the body which he says "moves." Yet a moment's thought would convince him of his error. When we say that a traveller sits motion*less* in a railway car, we do not mean to deny that he may meanwhile be moving through the landscape. All that we mean is that the parts of his body do not change their distance and direction from each other and from the parts and contents of the car. All these may meanwhile be rapidly changing their distance and direction from the objects making up the landscape. In regard to these he may be motion*full*. Thus, when we speak of anything moving in the physical sense, there is always latent in our minds the idea of something in regard to which it is moving; and its motion is a change in its spatial relation to that other something, that is to say, in its distance and direction therefrom. Now a relation, and a change of relation, may always be looked at, and spoken of, from the standpoint, as we say, of either party to it—in other words by identifying ourselves with either party to it. We are stating the same fact in the two ways possible when we say either that a traveller is moving past the landscape, or that the landscape is moving past a traveller. Only, in the first case we are thinking of ourselves as in the landscape and looking at the traveller, and in the second case thinking of ourselves as the traveller looking at the landscape. The one fact expressed by the two forms of statement is that a traveller and the objects composing the landscape are changing their relations of distance and direction from each other. Ptolemy and Copernicus described the motion between earth and sun with equal truth when one said that the sun moves round the earth, and the other said that the earth moves round the sun. Ptolemy looked at the change in the spatial relations of the two in the natural way, from where we all stand, namely, on the earth. But Copernicus imagined himself on the sun and told people to their surprise how

the same motion between it and the earth would look from thence. In a word, spatial motion is a *pas de deux;* and this is what is meant by the assertion, "All motion is relative." In the affairs of earth one standpoint is apt to prove the practical one. It is of little use to think of the globe as moving under the Gulf stream, and of great use to think of the Gulf stream as moving over the globe. We consequently ignore one of the possible standpoints, and may even deny its possibility and come to think of spatial motion as something belonging exclusively to the thing which we say "moves." But in astronomy the unfamiliar standpoint proved, all things considered, much the simpler way of looking at the matter; and this has led to the opposite error of conceiving Copernicus's conclusion alone true. A final step in thought brings out the fact of which two such statements are equally true accounts—this fact being that the two parties to a motion, in this case sun and earth, exhibit certain changes of spatial relation, either distance or direction or both. Have all lay enquirers into relativity taken this step? May it not rather be assumed that to many of them it will be no inconsiderable mental feat to part with the idea of spatial motion as something peculiar to the thing we say "moves," and take up with the idea that it is something which appears only when we consider another spatial thing—that is to say, a *relative* something? Having performed the feat, we no longer think, for example, of the nodding of a rose as we do of its redness. When we say it nods there is always something else in our minds besides the rose; but when we say it is red we need be thinking of nothing else. We are absolved, so to speak, from that necessity, and the rose from the companionship of its stem, or ourselves, or the ground. Things thus absolved from companionship in our thoughts are called for that reason, *absolute.* A first step in thought about spatial motion thus takes it from the number of absolute things, and puts it among relative things. Absolute motion then becomes to us a contradiction in terms.

2. Place and Space

Further, when we say a material body moves, we say it goes from one "place" to another. Let it be noted, in the interest of accuracy, that the motion called "translation" is here in mind, and not the motion called "rotation." This motion of translation, the lay enquirer is supposed to agree, is a change in the spatial relation of a body to some other. Its "place" may then be defined as the sum of its relations of distance and direction to certain other bodies. "Place," then, is also a relative term, implying the idea of other things than the body we say "occupies" it. Absolute place becomes also a contradiction in terms.

An essential factor in our ideas of motion and place still demands mention. When we speak of bodies moving from place to place we have in our minds certain things which we can recognize as the same things at different times in different spatial relations. It is not they but their relations which change, and we identify them by their inherent or absolute qualities. Now suppose that instead of bodies we are thinking of pieces of empty space. A piece of empty space has no inherent quality enabling us to recognize it as the same space that we thought of before. Pieces of space are not ticketed to our minds as piece *a*, and pieces *b*, *c*, and *d*. They are all alike in possessing the single spatial character. We must think of any piece of space as surrounded by other space, but we can not recognize it and that other as the same pieces that perhaps at an earlier moment bore the opposite relation. We can not say of a piece of empty space that it has a place in the surrounding space, since "place" means a sum of relations between things with recognizable qualities. Thus we can not say of a body conceived as existing in empty space, that it is either at rest or in motion, since it has no place therein either to keep or to change.

The idea that a piece of empty space has a place in surrounding space is the idea called "absolute space." This phrase we therefore abandon with the idea.

3 *and* 4. Length and Duration

Already we have made some progress toward a doctrine of physical relativity. We have concluded that spatial motion of translation is relative, and spatial place, with space itself, is relative also.

But the expositors ask us to drop other familar notions about the physical world. They tell us that, in a certain way, distance in space is relative, and that duration in time, when applied to spatial motion, is relative, too.

What this baffling statement means may be put thus—under correction from the physicists. Suppose two points on a body which preserve a certain distance, and a motion from one to the other which occupies a certain duration, when the body lies still before us. The baffling statement appears to mean that if the body is in motion regarding another observer in the direction of one point from the other, the distance observed by him to separate them will be less than the distance by which we see them separated, and that the duration of any motion between them will be greater than its duration to us, whatever the direction of the points relative to the motion of the body. Otherwise expressed, the distance between the points along the motion, or the "length" between them will be less, and the lapse of time between the event we call the start of the motion

from one point and the event we call its arrival at the other will be greater. Moreover, these differences will increase according as the motion of the body relative to the other observer increases. It appears, therefore, that both when we speak of the length between two points on a body and when we speak of the duration of a motion between them, there is something else in our minds besides the points and the motion; this something else being the state of rest or motion of the body regarding an observer. The length and the duration will both vary according to our choice of an observer. They are thus not qualities inherent in the points or the motion between them, but come to view first in considering someone who is observing them. In a word, both spatial length and duration of spatial motion are, in the certain way described, relative things. Professor Eddington expresses this at first baffling conclusion in the words "Thus length and duration are not things inherent in the external world: they are relations of things in the external world to some specified observer."

The layman need not ask to be shown in detail the proofs on which the physicist relies for his belief that length and duration in the physical world depend in this way upon the observer. Let these details be accepted with all the other recondite observations and far-flung reasoning from which the physicist gleans his results, and let only an inkling of the proofs suffice for his pupil.

In regard to length, perhaps the inkling may be given—again under correction from the physicist—by imagining a dialogue between observers on the earth and the sun, relating to the famous test of 1881, known as the Michelson-Morley experiment.

Terra. I have been experimenting lately with an optical instrument made with two arms at right angles, along each of which a ray of light may be passed. I have taken the greatest possible pains to make the two arms of precisely equal length. My results confirm the principle of the equal velocity of light in all directions, for the two rays take precisely equal times to accomplish their precisely equal journeys.

Sol. I have been observing your experiments, and my observations also confirm the principle of the uniform velocity of light. But I find that you are wrong about your instrument. The orbital motion of the earth around me has been carrying you along with it during your experiment, and my calculations show that were the two arms of your instrument of precisely equal length, the ray in the arm directed along the orbital motion would have a slightly longer distance to go than the ray across. But I detect a slight shortening of the longitudinal arm which I find to my relief is just enough to cancel the greater length of the ray's journey in it; and since

I also observe the two rays to complete their journeys in precisely equal times, I conclude like you to the uniform velocity of light in all directions. The singular thing is that this shortening does not appear a matter of the make of the instrument; for the arm directed along the orbital motion is always the shorter, whichever arm it happens to be.

Terra. But if the longitudinal arm is shorter, as you say, my test, instead of confirming, as I see it does, the principle of the uniform speed of light, would conflict with that principle. My observations would show that the longitudinal ray accomplished a shorter journey than the other, yet in equal time. In a word, I should observe it to go slower than the ray across. On the contrary, as I see it, the journeys of the two rays accomplished in precisely equal times, are themselves precisely equal, and the two rays therefore travel at precisely equal speed.

Besides, I was showing this experiment to *Luna* the other night, and she insisted also that one arm of my instrument was always shorter than the other, only that it was shorter in a different ratio and direction from that you assert. Which am I to believe?

Anyway, how does the fact that you and *Luna* are moving past me give you any right to challenge what I see with my own eyes? Seeing is believing, and what I see is that the two arms are equal.

Sol. Yes, seeing is believing, and whatever you or *Luna* say, I must believe in the particular shortening of one arm which I see.

Which of the supposed interlocutors is right? The relativist replies that each is right; for each is describing the relation to himself of the physical fact he observes with the others; and this is all there is to what we call length in this case.

In regard to duration, Professor Eddington writes (*S. T. and G.*, p. 24), "It is not only in space but in time that these strange variations occur." With this single statement the layman must be satisfied at this point. Professor Eddington does not amplify it; and in the sequel it appears that the proof of the relativity of duration is connected with the relativistic notion of *space-time*. On page 45 and the following pages Professor Eddington gives a mathematical deduction allied with that notion, of the variations both in length and in duration due to the motion of the observer. But into this mathematics it is not for the layman to enter.

The amount of these variations, we are told, depends on the ratio between the speed, relative to the observer, of the body observed, and the speed of light. The speed of light has been determined by experiment to be about 186,000 miles or 300,000 kilometers per second. The relativistic hypothesis is that the variations are always just sufficient to cover up any discrepancy from this speed

which an observer moving relatively to the source of light involved would otherwise note. This is an admirably ingenious but in no way unbelievable theory. The length covered by a motion in a certain duration gives its speed; and it is possible to assume that variations in the length covered, and the duration occupied, by the motion of a ray of light, due to the different motions of observers relative to its source might be such as would always give its speed to each as the same. "We now believe," writes Professor Eddington (*S. T. & G.*, p. 20), "there is something in nature which inevitably makes these compensations." Owing to them, a ray of light passing between two points of a body will always be seen by an observer at rest regarding the body, to reach one point from the other at the same speed, whether the body is at rest regarding the source of light, or moving toward or from it (*S. T. & G.*, p. 26). This view is a noteworthy one. For suppose two observers of a ray of light on two such bodies. If one body is approaching the source of light at a certain speed and the other receding from it at a certain speed, one would say that a ray of light from it would pass between the two points on one body at the sum of the speed of the ray and the speed of approach, and between the two points on the other at the difference between the speed of the ray and the speed of retreat. So it would be with other motions than that of light. If an express train passing a man on the track at forty miles an hour meets a way train passing him at twenty miles an hour, it would pass a man in the way train at sixty miles an hour; and if it overtook a freight train passing the man on the track at ten miles an hour, it would pass a man on the freight train at thirty miles an hour. But according to the physicist so it would not be, were distances shortened and durations lengthened for the men on the way and freight trains in the manner they describe. Both would see the express train passing them at the identical rate it passed the man on the track. The physicist supposes that this is the case with light, and the layman may accept (if provisionally in the matter of duration) both their argument and their supposition without seeking to enquire into either.

From the principle that the amount of the compensations depends upon the ratio between the speed of a body and the speed of light, impressive inferences are drawn by the physicist both in the case of the distance and the duration of motion.

In regard to distance, it appears that as the speed of a body increases with relation to an observer, the ratio of its shortening for him in the direction of its motion increases, until, when the speed of the body becomes that of light, the body is wholly shortened; that is to say, it has no size in the direction of its motion. It changes

from a material body in three dimensions to an abstraction with only two. Professor Eddington supposes (*S. T. & G.*, p. 23) a future interplanetary aviator flying past us at 161,000 miles a second in the direction of his length. At that speed we should observe his contraction in that direction to be one half. "If we could catch an instantaneous glimpse as he passed, we should see a figure about three feet high, but with the breadth and girth of a normal human being. And the strange thing is that he would be sublimely unconscious of his own undignified appearance." And since motion of translation is purely relative, "When he looks down on us, he sees a strange race of men who have apparently gone through some flattening out process." Again suppose "the aviator's speed is still further increased and approximates to the speed of light. Lengths in the direction of flight become less and less, until for the speed of light they shrink to zero. The aviator and the objects accompanying him have shrunk to two dimensions" (p. 26).

Mr. Russell expresses this result by the statement (*A. B. C.*, p. 40), "No material body can ever travel so fast as light." Mr. Russell had just written (p. 36) that on an escalator moving with the velocity of light "you would reach the top at exactly the same moment whether you walked up or stood still." This is puzzling, if no material body like an escalator can move as fast as this. Undoubtedly to affirm that you would *not* reach the top at exactly the same moment whether walking up or standing still would be false; but so it is false to affirm, as Mr. Russell does, that you would. Contrary affirmations are both false when the things talked about do not exist. This is the case with the escalator and with "you" conceiving them to be moving with the speed of light. As material bodies neither the escalator nor "you" exist. Both have become abstractions.

In regard to duration, it appears that as the speed of a body increases with relation to an observer—let us say the speed of an interplanetary aviator for an earthly observer—the ratio of expansion in the duration of motion upon it increases for the observer, until when the speed of the body becomes that of light, the duration of the motion becomes infinite—that is to say, the motion becomes rest. Meanwhile the body itself has also changed from a material body to an abstraction.

Professor Eddington illustrates this conclusion by the favorite fancy of an adventurer seen to travel from earth into space with the speed of light (*S. T. & G.*, p. 26); "He reaches his journey's end, say Arcturus, a decrepit centenarian. This is wrong. It is quite true that the journey would last something like a hundred years by terrestrial chronology; but the adventurer would arrive at his des-

tination no more aged than when he started, and he would not have had time to think of eating. So long as he travels with the speed of light, he has immortality and eternal youth." This illustration is puzzling like Mr. Russell's, and for the same reason. By Professor Eddington's previous conclusion just restated, there would under the circumstances assumed be no adventurer, no start, and no arrival. All would have become abstractions. The fancy appears enveloped in a contradiction. It assumes something which is at once a material body and no material body. Surely, not all the layman's difficulties with relativity are due to the doctrine itself.

Indeed, a fundamental difficulty which meets the lay enquirer at every turn of these expositions seems, to the layman who writes, of this adventitious kind. Pursuing the illustration of an interplanetary aviator who "flies past us at 161,000 miles per second," Professor Eddington writes (*S. T. & G.*, p. 23f): "In the aviator's opinion it is we who are travelling at 161,000 miles a second past him. We assume that we are at rest in the æther, whereas the aviator assumes that he is at rest." Here is a word new in the present discussion. What is "the æther," and what does the phrase "at rest in the æther" mean?

Professor Eddington writes elsewhere (p. 39f) that the ether "has, as it were, gone into reserve in physical theory," has become "a vague background." Later (p. 187) he writes: "What we have called 'the world' might perhaps have been legitimately called the æther; at least it is the universal substratum of things which the relativity theory gives us in place of the æther." Professor Eddington had before written (p. 40) that "in the constituent portions of the æther" "there need not be anything corresponding to permanent identity." "We cannot lay our finger on one spot and say 'this portion of æther was a few seconds ago over there.' Without any continuity of identity of the æther, motion through the æther becomes meaningless, and this is perhaps the true reason why no experiment ever reveals it." This is puzzling: for, if so, the absence of motion through the ether, that is to say, rest in it, also becomes meaningless, and both we and the supposed aviator have been using words without meaning.

But not quite, according to Professor Eddington. He writes (p. 42): "We believe that there are certain absolute things in the world —not only matter, but certain characteristics in empty space or æther." Conceiving of a region of empty space there is an "absolute structure in the region." But what is structure? It is the characteristic that distinguishes a differentiated from an undifferentiated group of elements. If we define "place" as the sum of the relations of one element in a group to the others, structure may

be called that characteristic of a group which gives its elements places therein. Thus if a region of empty space has a structure it is because the parts of the region have places therein. But we have already concluded that the idea that a piece of empty space has a place, is the idea called "absolute space" which we have understood relativity to abandon. Here we are, brought back to that idea again.

This is the trouble we laymen inherit when we assume the absolute structure in the substratum of things which relativists believe in. It is a great trouble to them. Professor Eddington writes (p. 38): "The most formidable objection to the relativist view of the world is the æther difficulty."

In his disappointment the layman may ask—Why need we believe in any substratum of things at all? Why do not the things themselves suffice? Does not the idea of a substratum recall the days when the earth was supported on elephants? Should not the idea be added to the number of "dangerous hypotheses" which Professor Eddington tells us (p. 28) have "insensibly crept into current physical theories" and which "the standpoint of Relativity proposes tentatively to do without"?

If we hold by the things themselves without assuming any substratum, the case between the aviator and ourselves seems very simple. There is motion between us at 161,000 miles a second, and this motion, like all motion of translation, can be looked at from the standpoint of either party to it. What need is there to "drag in" any third party, like the ether, and say we are at rest in it, and the aviator moving in it, or *vice versa*. If this is the case, the aviator and we are changing our relations of distance at the rate supposed. Why not say so directly? These are the facts, the things observed, while the supposed substratum is something which no one observes, and which apparently leads to an insoluble dilemma. If it have structure, empty space is the absolute thing relativity denies it to be. If it have none, motion in it and rest in it become alike meaningless.

The layman who writes feels constrained to join the sceptics of ether, whom Professor Eddington mentions (p. 39), but does not join, betaking himself for safety to the simple doctrine of the relativity of motion of translation. This resolve saves a layman ever-recurring difficulties with the expositions. Reducing the ether from the "somewhat shadowy" thing Mr. Russell says it has become in physics (*A. B. C.*, p. 29) to a non-entity, these difficulties also cease to exist.[1]

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[1] To be concluded in the next issue, No. 19.

THE DATUM AS ESSENCE [1]

THE theory that the datum of perception is a universal is shared by Messrs. Strong and Drake. It has been repudiated by the former, though not by the latter. This theory has been given in most detail, I believe, in *The Origin of Consciousness,* (1918), and in *Mind and its Place in Nature,* (1925).[2] As Mr. Strong's book is the clearer and as Mr. Drake says that he agrees with Mr. Strong, I shall in the main confine myself to it.

The theory may be briefly stated as follows. The perceptual datum is an essence of physical entities projected by mental states into time and space. It is inexistent, but in veridical perception it is somehow "part of" the physical object whose essence it is. What the properties of essences are I shall discuss without delay, emphasizing here that, as in Mr. Santayana, they are *of* things. This raises the problem of discovering what they are of. The things that they are of may be either physical or, in the case of introspection, psychical. The term "mental states" denotes "awareness," consciousness of," and the like, except that it connotes a process or activity, having presumably a beginning, a middle, and an end.

What, then, are essences?

To begin with, the term is obviously Aristotelian. Aristotle called that-which-made-an-object-what-it-was, its peculiar traits, its essence. Now it is clear that some of the things in the world are very simple. Instances of colors, sounds, and the like, considered in themselves, what Aristotle called " incomposites," do not differ from one another. Red is just red and its essence is thus its peculiar color. The essence of such a thing is apprehended, said Aristotle, in what would nowadays be called "immediate knowledge" or perception. But it is also clear that the essences of many things—of all non-sensibles—can not in Aristotle's opinion be perceptually grasped, but are known otherwise, through "reflection."

The essences of Messrs. Strong and Drake differ from Aristotle's.

To take up their traits in the order given by Mr. Strong (*Origin,* 38), they are first "whatever we can think of or know, considered solely with regard to *what* it is, and not as existing." At the outset one is aware of an assumption which is vital to the whole theory, namely, that what we think of is identical with what we perceive, that there is no essential difference between sensation and thought. Since this assumption is not discussed by our authors, it is only just to accept it as they do, noting, however, the fact that our acceptance of

[1] This is the fourth section of a longer study on contemporary theories which hold that the datum of perception is a universal.

[2] To be referred to as *Origin* and *Mind* respectively.

it is purely for purposes of discussion. The essence, then, is a universal (*Id.*, 39, 103), a "mere logical abstraction" (*Id.*, 125).[3] But it is a peculiar kind of universal, in that it "is perfectly concrete" and has "even the vividness of the sensible," when it is "of the sort given in sense-perception" (*Id.*, 39). This can only mean that there are two kinds of essences at least, the perceptual and the non-perceptual. But nowhere have I found Mr. Strong explaining why the perceptual essences are concrete and vivid and the non-perceptual not. "Vivid" one can understand, but "concrete" is more difficult to comprehend. Certainly it is the last word which would be normally applied to a universal.

The reason why the essence is a universal is that it is "indefinitely repeatable in space and time" (*Id.*, 39). To be repeatable in space does not mean that the essence is in space or in time (*Id.*, 89, 177). Yet Mr. Strong seems to admit that visual essences at least are extended (*Id.*, 99) and apparently move (*Ib.*). In fact he speaks about "an object at a certain distance" as an essence, not about its having an essence, but about its being one (*Id.*, 132). I should not imagine that the universal *redness* was extended, but obviously if it be visible, it must be extended. But if some essences are extended, what does one mean by their not being in space? Does one mean among other things that they do not necessarily depend for their being upon a given position, or does it mean that they are not three-dimensional? After all, the former characteristic is not peculiar to essences; it pertains to any moving body. The second also pertains to particulars—any surface has only two dimensions, but is not therefore a universal. Nor are moving bodies and surfaces non-spatial in the usual meaning of the word.

Again, there are certain qualifications to be made of an essence's timelessness. Though essences are not in time, Mr. Strong admits in at least one instance—that of the negative after-image—that they change (*Id.*, 97). The negative after-image is not the essence of a physical object; it is the essence of "a certain psychic state" (*Id.*, 95). Nevertheless, as he says, it is an essence, for "since it is given, and only essences are given, it must be one" (*Ib.*). He does not

[3] Cf. *Mind*, 68. But see, however, the footnote on *Mind*, 8. "But of course what I am aware of may be a particular. That particular is, then, my 'datum,' the essence 'given' to me. The term 'essence' need not be contrasted with the particular, or the concrete, or indeed with anything. The class of essences is the inclusive class, covering anything that can be mentioned." Surely Mr. Drake is exaggerating. If essences include everything, like Mr. Holt's "being," they connote nothing and it is no more enlightening to say that perceptual data are essences than it would be to call them "beings." In other words, the term becomes meaningless. The footnote concludes, "We are, indeed, aware of particulars, and of actually existing particulars."

assert, as Mr. Santayana seems to in analogous cases, that the changes in the negative after-image are a series of discrete essences; he says, on the contrary, "While we observe the after-image, it goes through a course of changes—it gets less and less brilliant, and then becomes dark" (*Id.*, 97). It is, then, not timeless, so that it becomes an exception to the rule that essenses are out of time. Mr. Strong does not appear to be aware of the danger of this exception; he makes no attempt to explain it away, which is courageous, but fails to see that some such explanation is necessary if its lack is not to invalidate the whole theory. In what sense does a negative after-image differ from any normal veridical percept? Only in the conditions under which it occurs. But these conditions are not given in immediate perception and the reason why we are led to investigate the special nature of such phenomena as negative after-images is that they do not differ in appearance from veridical content.

We have seen that the essence is a datum, or more strictly that all data are essences. Yet Mr. Strong also maintains that (in spite of their sensible vividness) they "are mere intent," "not sensible facts" (*Id.*, 179). All data are essences, but we learn to our surprise that "a datum is everywhere a physical property or state" (*Id.*, 93); surely an ambiguous clause; that one of the requirements of logic is that the "object" must be "directly known" (*Id.*, 188) in order to avoid subjectivism and representationism; that "the great fundamental illusion" is "mistaking the essence for the object" (*Id.*, 191); that in introspection "the self is not only the true but the sole datum" (*Id.*, 105).

Essences are normally essences *of* things not themselves, the qualities of objects, which permits Mr. Strong to feel at least as realistic as Mr. Dawes Hicks. But sometimes there are essences of nothing, floating qualities which our minds pick up as their antennæ brush them. This permits Mr. Strong to account in a way for error. He wavers restlessly between these two points of view: sometimes he writes as though there were no "direct vision" of an essence's object; at other times he writes as if an essence were one of the object's "parts." For instance, he speaks of the possibility "for an essence to be given which is really the essence of the object. When this is so, cognition is at once direct and true" (*Id.*, 41). Again, "Because what we are conscious of is the essence, this universal, which may be *identical* with the essence of the object, we are able, despite the externality of the mechanism, to contemplate—precariously, as I have said—the true inwardness of the object" (*Id.*, 42).[4] Mr. Strong

[4] Or again, "Two things are said to be 'distinct' when one has a different essence from the other. . . . If by 'percepts' we mean the essence given, this essence and the essence embodied in the object are not distinct" (*Id.* 43). As

probably exaggerates his case in order to escape "representationism" (*Id.*, 43), as when he says that the essence is the object without the object's substance (*Id.*, 175) or existence. It is obvious that he does not avoid representationism by such assertions, for as long as the datum is not the whole object, as long as there are parts of the object which can not be given, those parts are represented by what is given and one's theory of perception is dualistic.

This is all illustrative of Mr. Strong's ambiguity. At times he uses the word "essence" as very much like the Aristotelian essence and at times as a perceptual quality or property of an object. By what would be a pun, if he were not serious, he slips from one meaning to the other, using the former to explain veridical data, the latter to explain error. Thus when the datum is an essence, meaning a perceptual quality, perception may be invalid; but when it is an essence meaning "the inner nature," perception is valid. The impossibility of the identity of data as he describes them and any part of a physical object can easily be proved. They can not be one if they have incompatible properties. But they are bound to have incompatible properties if the datum is a universal, for the physical object is certainly a particular. It is a particular if it is the ordinary physical object of common sense and also if it is the "scientific object." The essence is timeless, they are in time; a timeless entity may be a sign of one in time, but it certainly can not be identical with it.

If the object of which Mr. Strong is speaking is the "scientific object," its relation to the essence becomes even more puzzling. The scientific object is by definition imperceptible, so that the datum could not be its essence in the sense of one of its qualities. Since the inner nature of the scientific object is to be infra-perceptual, the datum could not be its essence in the Aristotelian sense of the word. If the object of which Mr. Strong is speaking is the physical object of common sense, i.e., the total object as perceived, any datum might be one of its qualities, but could never be its Aristotelian essence, for according to Mr. Strong's premises its existence is never given and it is certainly an important item in the essence of physical objects.

The next question which arises is how we reach the objects through their essences. In Mr. Santayana we reach them by animal faith. In Mr. Strong the process is much the same except that it is

a matter of fact, according to this definition of "distinct," two essences could only be distinct if each essence had an essence and so on. Mr. Drake is more definite. He says that the primary qualities "*of our normal perceptual data* may (in so far as perception is accurate) be regarded as literally features of the existent world in the midst of which we live" (*Mind*, 53; but see 55, n. 1). This may be justifiable, but certainly not because of any felt difference between the normal perceptual data and the abnormal.

more fully explicated. Essences have three groups of properties to each of which he gives varying emphasis. Ontologically, for instance, they are inexistent and can appear identical in veridical perception and in hallucination. Psychologically they are (*a*) the termini of sensations and acquire almost a subjectivistic tinge when he speaks about their being "brought before the mind" by various sensations (*Id.*, 132), one of the few clues he gives as to the mode of their appearance; (*b*) they are used by intellection to round out incomplete experiences (*Id.*, 118), though he does not explain how intellection knows which ones to choose. Logically they are signs, "meanings" as Mr. Drake calls them (*Mind*, 188), and thus have a logical self-transcendence. It is through their transcendent reference that we reach their objects when they have any.

But Mr. Strong does not mean that our passage from these signs to what they signify is logical (*Origin*, 39). We do not find evidence of an object's existence in the presence of its essence; we act as if it were present. Mr. Strong refers to this act as an operation of "instinct" (*Id.*, 47).[5]

This is not, however, an answer to the question. For if a given essence may now be veridical, now illusory, why does the instinct now act as if an "object" were present, now as if it were not? How does it know which data point to physical objects and which do not? That it soon acquires such knowledge is a fact; we seldom mistake images for percepts. One does not believe, for instance, that the spokes of a wheel fuse into a solid disk as the wheel begins to revolve. Nor is it by an irrational saltus that we discover the truth. When we are in doubt, we reason about our data (or can if we will) and resolve our doubts. If we moved by a faculty which might properly be called "instinct," why is it so often hesitant? I have elsewhere listed a number of absurd propositions which would be plausible if immediate data of a single sense at a single moment were the sum total of our wisdom;[6] as a matter of fact they are not, and not even Mr. Strong believes that they are.

The reason why Mr. Strong, like Mr. Santayana, believes that the process of positing existence is irrational, is because his conception of the word "reason" is a bit narrow. It is true that no term by itself implies anything; it might just as well be nonsense. "Redness," "triangularity," "man," what can one reason from these terms in isolation? Again, no universal implies "existence." But "existence" is not peculiar in that respect. We have to know the

[5] Mr. Drake also believes that essences are guides to action (*Mind*, 193), but it is difficult to explain how "purely imaginary" things could be. Nor does he explain.

[6] "The Truth of Immediate Knowledge," this JOURNAL, Vol. XXIII, No. 1.

signs of a thing before we can logically begin to reach it. But the relevancy of non-conventional signs is learned, it is not intuited. Who could argue logically from a man's finger-prints to a man without first knowing the individuality of finger-prints?[7] Such knowledge can never be completely acquired, I admit, in the case of natural objects, but certain reliable hypotheses can be formulated and are formulated.

The same remarks apply to "existence." A baby likes to touch what it sees, as if touch were an infallible sign of physicality. So Destutt de Tracy made the feeling of resistance a sign of external existence. For all I know, there may be tactile illusions just as there is tactile anæsthesia. One suffering from such illusions would not admit the reliability of such a proof. But I venture to suggest that the suppression of all hypotheses or postulates in thinking would not open the way for "instinct," but for silence. It is an old story and my suggestion will seem very banal to students of the history of philosophy. The point is, as everyone knows, that reasoning is as much the testing of hypotheses as anything else; that is its way of behaving and it is folly to upbraid it for what it can not help.

In other words, the logical fertility of a concept, term, proposition, or what you will, is not self-evident. Logic begins after one has discovered or assumed the relations between entities. The contemplation of an essence or any other meaningful term is not sufficient to reveal its implications. When it seems to be, it is because we have formed the habit of linking the two entities together and are no longer aware of anything other than the termini of the process. It has usually been acknowledged that logical order is not the order of learning nor of existence, but is a rearrangement of what is learned. Hence in moving from the datum of sense beyond, we obviously can not move without making certain guesses or hypotheses. Memory, habit, learning, guide us in our guessing and that our hypotheses are an articulation of our past experience ought to occasion no surprise. It is not a sign of their invalidity or illogicality. Is a biologist or a chemist using an illogical or an "instinctive" process in correcting his guesses by experiment? The process is behind all our reasoning, is what makes us suspect the applicability of our reasoning to the "real world" and what permits us to reason instead of acting. Hence to call the positing of an existent beyond the essence by a derogatory name is gratuitous libel. We may make mistakes at times, but even mathematicians make mistakes. The trouble is that we demand a kind of apodictic certainty in epistemology which is found nowhere else and which we have every reason to believe is unattainable by human beings.

[7] Cf. the beautiful discussion in Mr. Santayana's *Dialogues in Limbo*, p. 110.

II

There remains one question which must be put to all theories that the datum is an essence. It is the question of how inexistent timeless essences appear before the mind. To save space I shall confine myself to the views of Messrs. Strong and Drake. The reader may apply the criticism to other views at his leisure.

One would suppose essences to be independent of human beings according to Mr. Strong's definition of "independence." Two things, he says (*Origin*, 42), are independent "when one can exist without the other." As the realm of essences is intermediate between the Ego and its objects and as its inhabitants are immutable, one might imagine them to be independent of us. We light upon them; we do not create them.

Yet to read *The Origin of Consciousness* is to see to how great an extent they are dependent upon us. If there were no human beings or animals "higher" than human, it is doubtful whether "gold mountains," "round squares," or anthropomorphic gods would subsist. So many of our essences seem to be the literal effects or products of the human equation that the only other explanation of their appearance would be that human minds were made to fit them. It may be, for instance, that God created toothaches first and then teeth to fit them, that He created visceral sensations and in His infinite mercy made viscera to suit. Though Mr. Strong's theory would seem to imply such a cosmogony, he admits that some essences are functions of the human mind.

For both he and Mr. Drake refer to the phenomenon of fusion, which Mr. Strong in his later book, *A Theory of Knowledge*, (1923), calls "confusion," and in his articles in *Mind* (January and April, 1926), "The Genesis of Sensible Appearances," calls "simplification." Fusion is the welding together of many *petites perceptions* into a datum which has no parts. Few psychological facts are better attested than this. Whatever examples may be chosen to illustrate the process, it produces out of a variety of elementary data, of which one may or may not have been aware, a datum which has every appearance of simplicity and as a datum is, of course, simple. But the resultant simple datum is, as all explanations are bound to concede, a function at least of the original *petites perceptions*, their interrelations, and the human nervous system. If these were different, the datum would be different. And it is not inconceivable that if the human sensory equipment alone were not precisely what it is, the simplifications would be different. So in the mixing of pigments, the original elemental colors are not visible, but nevertheless determine what derivative color will be seen.

If these facts are admitted, and they are insisted upon by Messrs. Strong and Drake in the metaphysical portions of their books, what becomes of the timeless inexistent essence which the mind beholds, but takes no part in producing? Is there any difference in the effectuating of these simplified data and that of anything else which is a function of definitely existing things? In many cases we know that we can control the effect by controlling the physical stimulus and can thus prove its partial dependence upon the physical stimulus. If it is desirable to call the effect an essence, well and good, but surely it is no longer an Aristotelian essence, for it is the inner nature of nothing but itself; nor yet a quality, for it is a property of nothing in the sense that color is a property of objects; nor timeless, being both dated and mutable; nor spaceless, being (at least in the case of vision) not only extended but localized.

A possible answer to this criticism is that the process of fusion does not create a new essence but merely directs our intuition upon a new one. This is possible, but is not the answer of Messrs. Strong and Drake, for, indeed, unless the process is a real one operating upon fusible elements, it is of little value to their theories. In fact the incompatibility of such appearances with the doctrine of essences is practically admitted by Mr. Strong in his "Genesis of Sensible Appearances," although Mr. Drake refers to these articles as if they were harmonious with the epistemology of *The Origin of Consciousness* (*Mind*, 140, n. 1). It is obvious that such dated products must be particulars, for the only genesis attributable to universals is the fertility of implication. But no one would maintain that the products of fusion were caused by a logical implication of their elements.

But perhaps the best argument against these theories is that the datum does not look nor act like a universal.

On the theory of neutral being, the only reason why all universals are not perceived is accidental. But there are certain properties of universals, above all their universality, which in the nature of things could not be perceived. One does not see the repeatability of a patch of redness; one sees a red patch. To know that something is repeatable requires memory and recognition. When one perceives a quality, one is aware of just that particular entity at that time (plus certain associations and the like which are more important psychologically than epistemologically) and when the quality is remembered, it is remembered as that particular entity of that particular time. Its logical traits are a discovery which could not be given. If this were not so, why should we spend so much time trying to identify and classify our experiences? The repeatability of a datum can be discovered only after the datum has been repeated and reflected

upon. Hence if the criterion of universality is repeatability, the datum could not look like a universal.

Similarly if a universal is spaceless, some data can not be universals. For whether visual data, for instance, are in public or in private space, they are in some space. A red patch is so many centimeters long—but redness can not be or the old puzzle about the exhaustibility of universals would arise. It is to the right of this and above that and near the other. It has a dozen and one spatial properties which a true universal could not have.[8]

Moreover, the datum does not act like a universal. The only characteristic like causation among universals is implication. The authors I have treated either confuse the causal relations of data with implication (Mr. Holt) or deny that they have any. We have two typical cases of such relations which I should like to indicate here.

1. We know from experience that if a given visual datum is in a certain spatial relation to a mirror, it is duplicated. If the patch of color is homogeneous, it is visually identical in the mirror and out of it except that it will probably be brighter in the mirror. But if it have an irregular shape, it is discovered to be reversed and, of course, there is no reason to doubt that it is always reversed. In what sense of the word could a purely logical, a spaceless and timeless entity, be reflected in a mirror? This is not merely a rhetorical question. It will, I think, be admitted by everyone that the mirror-image is not simply another datum, but is causally related to its original, so much so that one has only to change the original in the slightest degree to effect a change in it. But if it can change, it is, I should imagine, no universal. Moreover, if all mirror-images are reversed, we have on the theory of essences an inexistent, timeless, and spaceless entity undergoing a very elaborate causal operation. Now if the mirror be warped, the datum is still further modified. I submit the following alternatives: either the mirror-image has no causal relation to its so-called original, or it is no universal. It seems to me more reasonable to assert the latter and deny the former.

2. To turn from elementary physics to psychology, we discover that the datum is modified by other data in the contemporary perceptual field, by memories of past data, by what one expected before it entered one's perceptual field, as well as by other psychical facts. If one takes a universal like "humanity," one assumes, I believe, that its connotation is a constant; indeed, there is very little other ground, as far as I know, for calling it "timeless." The same thing ought to

[8] Cf. A. O. Lovejoy; "La théorie de la stérilité de la conscience dans la philosophie américaine et anglaise," *Bull. de la Soc. Française de Philos.*, 25e année, nos. 4–5, Oct.–Dec., 1925.

be true of "redness." If, then, data are universals, why are not the universals which are data constant as to their connotation? The thought "redness," or the judgment, "This is red," can arise when there is next to no perceptual evidence for it. Anyone who has studied painting knows how difficult it is to find a pigment which is, as one says, "pure." Similarly—indeed, partly for this very reason —it is difficult to find a perceptual datum which is pure. It is adulterated, not only physically, but psychically. This, one might object, can be easily done away with, just as the chemist does away with the impurities he encounters. The fact that it has to be done away with shows that it is there and that the duality of the universal and the perceptual has not been reduced. For if percepts of red were literally "redness," why should they ever differ?

Mr. Holt in 1914 argued that they must be the same; that if x and y were both, say, red, there must be a common quality, "redness," in both x and y. There must, indeed, when one is thinking about them, just as every circle must be round. But just as no perceptual circle is round, though on the essence-theory it ought to be, so no—or very few—perceptual reds are spectral reds. That this is so may be discouraging to Platonists, but on the whole it is a tribute to the economy of thought. It is a kind of evidence of how different thought is from its subject-matter and of the whole process of classification and abstraction. I suggest that the difficulty arises over a misconception of what a common property is. It is usually supposed that members of the same class must all have some property which can be abstracted from them and considered by itself in isolation because it exists in each of them as a self-identical entity. This seems, before one reflects about it, to be the case with perceptual properties —colors, shapes, sounds, odors, etc. But one can easily see that it is not always the case. Mr. Russell has shown that when a number of terms have a given transitive symmetrical relation to a given term, they form a class. And it will be seen that if a number of terms have a given relation to another term, whatever the character of the relation, they will or can be given a common name, and so be popularly suspected of having a common property. Everything east of Suez may form a class of terms called "orientals" and may be said to have the common property of orientality; but no one would maintain seriously that there was a property, orientality, resident in all orientals. For if he did, how could he avoid the fallacies which Socrates committed in the *Theatetus* (154, 155) when he argued against relativism? The hypostatising of relatives would lead to such logical absurdities that one would feel willing to go to any lengths to avoid it. A familiar case would be the following: one

can say truly that the sums of the angles of all triangles are equal; but is the sum of the angles of any given triangle equal?

The hypothesis of common properties—though apparently justified in sense-perception—needs much qualification before it can be applied to all classes. But in a paper of this sort, such qualification can not be made.

There is a final argument against these theories (with the exception of Mr. Holt's) taken in a body. They all, it will be recalled, posit the existence of a physical object of some sort, a concrete particular, as the transcendent reference of the perceived essence. The object is something which has never occurred before and never will occur again, unless the Earth's great year begins anew. How could one ever infer from a universal more than that, if it were correlated with a physical object, the physical object would be of such and such a nature?[9] But that, for instance, redness-in-general is evidence of this or that particular event in space-time is obviously an illegitimate inference. The believers in the essence-theory agree, and conclude—except in Mr. Hick's case—that therefore faith or "action" will posit what reason denies. The answer is that faith—if thus aroused—and action would come to grief unless things were as the illegitimate inference concludes. But that in turn means that we have probably a true conclusion following from false premises. This point, however, has been discussed above and we shall accordingly not repeat it. The issue is as follows:

(*a*) The essence theory.

1. The datum is a universal.
2. It has transcendent reference to a particular.
3. But a universal can not logically imply the existence of anything.
4. Therefore the existence of the transcendent reference is posited by a non-logical but reliable act of faith.

(*b*) This paper.

1. The datum is not a universal, for
2. It has transcendent reference to a particular,
3. And a universal can not logically imply the existence of anything.
4. Nevertheless the existence of the transcendent reference is discovered by the same type of reasoning as is used in any other inference.

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[9] Cf. C. D. Broad in the symposium on critical realism in *Arist. Soc., Supp. Vol. IV*, 1924, p. 114.

BOOK REVIEWS

The Philosophy of Helvetius, With Special Emphasis on the Educational Implications of Sensationalism. MORDECAI GROSSMAN. (Teachers College Contributions to Education, No. 210.) New York: Bureau of Publications, Teachers College. 1926. 181 pp.

This essay is the dissertation of a candidate for the Doctor's degree at Columbia University. As a venture in the criticism of an historic educational philosophy, it constitutes a by no means unprecedented, but nowadays nevertheless somewhat unusual, investigation in the field of education. It is none the less welcome and relieving in the midst of the deluge of theses on educational administration which ambitious aspirants to educational leadership have of late years been pouring forth.

While the name of Helvetius is one commonly enough on tongue or pen, very rarely are his definite contributions to philosophy or politics discussed at length. The reason would seem to be, as Dr. Grossman clearly points out, that he made no contributions. He represented the spirit and the ideas of a school and a time. His sentiments and aspirations are those of the *Illuminati* of the early eighteenth century in France. His philosophy is an expression and a defense of this attitude. The merit and the defect of Helvetius lies in the extreme form in which he presents these views.

The philosophy of Helvetius is a simple one. It is the materialism of la Mettrie and d'Holbach, the sensationalism of Condillac and the hedonism that afterward received its most memorable exposition from Bentham. Mind, to begin with, is purely passive, a *tabula rasa.* Memory and intelligence are derivatives from the primal sensibility. Pleasure and pain are the controlling forces of action. Self love dominates conduct. It is the business of society through rewards and punishments to create a situation in which each can secure his own happiness only in ways consistent with the greatest happiness of the greatest number.

Such a philosophy makes man wholly a creature of his environment—not the natural environment alone, nor in the main, but the cultural one. Education is the all-powerful force. The prince and the peasant differ because they have been bred differently. Distinctions of caste are man made, and largely they are clever devices for tyranny and exploitation. The reform of society depends, therefore, upon proper legislation and efficient education.

Dr. Grossman makes it clear that the extreme philosophical position of Helvetius is an outcome of a practical hope in the possibility of social reconstruction. To Rousseau man is by nature good. Civilization had corrupted him. The best service to him, therefore, is to

let him alone. To Helvetius man is originally unmoral and is given his character by his surrounding. Such a philosophy, Dr. Grossman pertinently remarks, affords a foundation for a platform of positive human betterment, whereas the defenders of the *status quo,* of privileges, tyrannies, and social abuses of all sorts support their attitude by reminding us of the incurable defects in human nature.

Dr. Grossman does not pose as a partisan of Helvetius. His aim is exposition merely. He gives us a very painstaking and scholarly, if somewhat repetitious, survey of the relations between the thought of his philosopher and that of the other intellectual leaders of the time, Locke, Voltaire, d'Alembert, Montesqiueu, Condillac, la Mettrie, d'Holbach, La Rochefoucauld, Turgot, Quesnay, Beccaria, Bentham, Diderot, Rousseau, and many others. He concludes apologetically with a short criticism of the inadequacy of Helvetius from the standpoint especially of Professor Dewey.

In these days, when factors of native endowment are so much emphasized, when the belief in the futility of legislation obsesses the minds of so many, when educational achievement seems everywhere so stalled by the recalcitrancy of its material, the environmental philosophy of Helvetius, in spite of its naïve and often absurd assumptions, may well hearten those working for social betterment through either the school or the law. If so, then the excellent exposition of Dr. Grossman may serve other uses than that of scholarship alone.

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Correspondence of Descartes and Constantyn Huygens, 1635–1647. Edited by LEON ROTH. Oxford: Clarenden Press. New York: Oxford University Press, American Branch, 1926. Pp. lxxv + 351.

The appearance of this edition of Descartes' letters serves to fill another of the suspected lacunæ in the history of thought. It makes one less of the vast number of such unedited documents which await, in the libraries of Europe, the initiative of editors and learned bodies. In this case, however, the collection came to publication by a rather more adventuresome route than library research: Dr. Roth details in an introduction its history from the time it passed into the hands of Huygens in 1659 on the death of Descartes; he reconstructs the story of its passage, probably by hereditary processes, into the Sypenstein family, its purchase in 1825 by the bookseller Thorpe, and finally the sale in 1833 by which it came into the possession of the Buxton family. It is now, by the gift of Mr. L. H. Dudley Buxton, in the possession of the *Bibliothèque Nationale.*

Of the 129 documents contained in the collection, 91 have never been published before: 52 letters of Descartes, 29 of Huygens (the father of the great mathematician and scientist, Christian), 1 of Mersenne, 3 of Van Surck and 6 documents relative to the controversy between Descartes and the mathematician Stampioen. They have been printed beautifully at the Clarendon Press, annotated with introduction and appendices by Dr. Leon Roth, and with a foreword by M. Charles Adam, who completed the great French edition of the works of Descartes after the death of M. Tannery. In respect both of form and contents, it is a fitting and indispensable supplement to the eleven folio volumes of the Tercentenary edition.

Nevertheless, there is very little to be found in so many documents to elucidate the problems presented in the philosophy of Descartes. Constantyn Huygens, seigneur de Zuylichen, was devoted to science, but in the degree and fashion suited to one in the service of the Prince of Orange as Minister of War. The interest of the correspondence is therefore in that Huygens served for a time as intermediary between Descartes and Mersenne, in that he read some of Descartes' works as they appeared (he seems to have been the first to have read the *Discours*), in that he advised Descartes, used his influence in his behalf, and joined in the chorus of his friends urging him to the publication of his works. The tone of the letters is set by such friendly discourse, with the interjection occasionally of the suspicion that Descartes tolerated the enthusiasms of the philosopher amateur to conciliate the man of state.

The correspondence opens with a characteristic incident. While at Amsterdam Huygens had heard Descartes read a portion of the Dioptrique—doubtless Discourse VI, since it had to do with grinding hyperbolic lenses. On his return to la Haye he tried to have some lenses ground according to the directions of Descartes. The experiment succeeded rather badly, however, and the talk of it is dropped after five letters. The twelve years of correspondence which follow relate chiefly to Descartes' private life, to the progress and publication of his works, and the state of mathematical and scientific controversies. Huygens read the *Discours de la Methode* with vast enthusiasm and raises the question of the propriety of the word *Discours* in the title; Descartes justifies it in that the treatise deals, not with method, but only with some questions relative to it; he compliments Mme. de Zuylichem's judgment, requests her opinion, and later, when it is a question of the *Dioptrique* and the *Meteores,* adds Huygens' sister and daughter to the list of his female advisers; he goes into the details of his uneasiness in the controversies with Stampioen and with Voetius, and expresses great inquietude and perturbation in the former case when he learns that Stampioen is the tutor of the

Prince of Orange; the publication of the Meditations occupies him for a time; he considers the prolixity of the fifth *Objections* and contemplates omitting them; he speaks scathingly of Pascal's new experiments with vacua.

Obviously there is little here that will add to the knowledge of Descartes' philosophy. M. Adam notes, indeed, in the foreword that it is not the philosophy, but only the philosopher, who appears more clearly than before. In some instances of letters which were published under the editorship of Clerselier, simple justice is done him in this more accurate text. If those letters be compared with the readings of Clerselier given in the notes, at least some of the tergiversations and hesitations of Descartes before the dangers of theology and its defenders are seen to have been dictated by the sensibility of his editor rather than by the faintheartedness of Descartes. So, when Descartes spoke of the sweeter and more tranquil life to which those who die pass, his cautious editor, mindful of the good Christian doctrine that all who die do not go to heaven, wrote in "the greater part of those who die," and when Descartes opposes what religion teaches us to what natural reasons persuade us, Clerselier so far forgot his function of editor as to introduce a subordination of reason to the truths of religion "which faith alone teaches us and to which our reason can not attain."

It is an incalculable service to scholarship that these documents should have been published; that they should have been presented so ably and beautifully adds to the sum of the debt. The student of Descartes will find them invaluable both as source for additional material and as exoneration; the student of philosophy will find little to interest him directly. But there is the suggestion that they may prove to have still another value, for there are here some of the minutiæ of the scientific discussions of the seventeenth century which are passed over easily now as antiquated; possibly when the history and philosophy of science come to be written they may take on a new significance.

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Fiktionen in der Mathematik. CHRISTIAN BETSCH. Stuttgart: Fr. Frommanns Verlag (H. Kurtz). 1926. xxiv + 372 pp.

Though it is not long since the appearance of Vaihinger's *Die Philosophie des Als-Ob*, the interest which it has aroused has been evidenced both in the demand for the book and in the numerous contributions of other authors to the philosophy which it describes. From the nature of Vaihinger's theses it was inevitable that many of the writings dealing with them should be of a critical character.

In *Fiktionen in der Mathematik*, Christian Betsch attacks the theory of fictions, central in Vaihinger's work, from one angle. Perhaps one can find some measure of the thoroughness and success of this treatment in the fact that it was crowned by the Vienna Academy of Sciences in 1926.

In the compass of a few paragraphs it is not possible to state the theory of fictions or to indicate the types of fiction which occur in it. The concept which is immediately under discussion may best be epitomized in Vaihinger's own words: "Fiktion menne man jede bewusste, zweckmässige, aber falsche Annahme;" "In den Semifiktionen ist stets eine willkürliche Abweichung von der Wirklichkeit, also ein Widerspruch mit derselben auffallend, der bei den echten Fiktionen sich zum Selbstwiderspruch steigert." Vaihinger believes that such fictions are at the base of mathematics, that mathematics reaches its valid conclusions by a process of "compensating errors." He builds up an analogous theory for a wide range of human thought.

Betsch first gives a brief exposition of the fundamental ideas of *Die Philosophie des Als-Ob* and then indicates the several directions which his investigations will take. The underlying ideas "reality" and "truth," which occur in Vaihinger's definition of a fiction, are variously interpreted; and the meaning of "fiction" varies with the interpretations accepted. The first portion of Betsch's work is devoted to the thorough analysis and classification of the possible types of fiction thus arising. The notion of "purpose" which appears in the definition is made clear in Vaihinger's own exposition: he treats thinking as an organic process whose end is the subjugation of events to the organism and regards the fiction as a device to further this end. Betsch does not consider this phase of the theory. There remains the question of fact as to whether specific fields of knowledge are based on fictions in one sense or another, in particular whether those fictions involved entail logical contradictions or not. The second part of *Fiktionen in der Mathematik* is devoted to the examination of mathematical knowledge from this point of view.

The author is modest and self-effacing to the point that he rarely advances either theories or opinions of his own. He confines himself almost entirely to the exposition of the work of other writers on philosophy and mathematics. A mathematician would be justified in taking offense at Vaihinger's misinformation about mathematics; but he could read Betsch's discussion of its foundations with a feeling of satisfaction.

At the present time mathematics involves certain contradictions, politely called paradoxes, which appear to be of a very subtle character. Though numerous efforts to cast them out have been made, there is no agreement as to the method which should be pursued.

The source of these contradictions has been localized to some extent: one can say, in brief, that the problem of mathematics is the problem of the number-continuum. Actually, there are several specific problems cloaked under this phrase. The natural numbers have to be introduced axiomatically and at the same time significantly, in a peculiar way; the system of definitions and axioms must then be shown to involve no logical contradiction. The situation is not analogous to that of a set of geometrical axioms; in the case of geometry, the system can be built up without regard to the significance of the terms, and the logical investigation of this system is then reduced to the discussion of the number-continuum by the exhibition of the point, line, or other undefined elements as numerical in character. Once the natural numbers are obtained, it is not difficult to pass to the rational numbers. The next step is the construction of a "number-continuum by the introduction of irrational numbers. To accomplish this it seems to be necessary to employ the concept of an infinite set or class. In connection with this concept arise most of the contradictions and difficulties which render the present state of mathematical knowledge critical and unsatisfactory. Logicians and mathematical philosophers have long studied the situation; but in recent years, such distinguished mathematicians as Hilbert, Weyl, and Brouwer have written extensively on proposed ways to a sounder state.

It is apparent that Vaihinger's picture of mathematics as a grotesque system of compensating errors accepted without protest is a false one. Though there may be subtle logical contradictions and defects in mathematics, they are present only as "unwelcome guests," to be evicted as speedily as possible. If Betsch has made this quite clear to his philosophical readers, the length and minuteness of his treatise have effected a useful end. Nevertheless, the position of the theory of fictions with regard to mathematics must perforce remain indeterminate for the present. If, as we may well hope, mathematics can be rid of its paradoxes, the fictions of mathematics are weak and anæmic, destined to be the pawns of "realists" and "idealists." On the other hand, if an unprecedented effort of human thought can show that mathematics must always contain paradoxes, the entire science must take its place as a magnificent fiction; because of its immense practical importance it can not be abandoned. We must reserve judgment.

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JOURNALS AND NEW BOOKS

ZEITSCHRIFT FÜR PSYCHOLOGIE. Bd. 103, Heft 1 u. 2. Zur Psychologie sogenannter Abstraktionsprozesse. Untersuchungen über das "Ordnen.": *E. Weigl.* Das Problem des Instinktes: *Ch. Bühler.* Der Schlummerzustand: *A. Angyal.* Über die zeitliche Orientierung im Schlaf und einige Aufwachphänomene: *K. Frobenius.* Die Orientierungstäuschungen: *F. Baumgarten.*

Croce, Benedetto: An Autobiography. Translated from the Italian by R. G. Collingwood. With a Preface by J. A. Smith. Oxford: Clarenden Press. 1927. New York: Oxford University Press, American Branch. 116 pp. $2.00.

Walther, Andreas: Soziologie und Sozialwissenschaften in America, und ihre Bedeutung für die Pädagogik. Karlsruhe: G. Bruan. 1927. 143 pp. 5 mk.

NOTES AND NEWS

We learn with great regret of the death of Professor Edward Bradford Titchener, Professor of Psychology in Cornell University, which occurred at his home in Ithaca on August 2.

Professor Titchener was born in Chicester, England in 1867. He received the degree of B. A. from Oxford in 1890; Ph. D. from the University of Leipzig in 1892; M.A. from Oxford, 1895; D.Sc., Oxford, 1906; LL.D., University of Wisconsin, 1904; D. Litt., Clark University, 1909; D.Sc. Harvard, 1909.

He became professor of psychology in Cornell University in 1892, becoming successively Sage Professor of Psychology in 1895; Sage Professor of Psychology in the Graduate School in 1910, which position he held until his death. In 1896 he became Professor of Music at Cornell for two years. He was co-editor with G. Stanley Hall in 1895 of the *American Journal of Psychology* and became editor-in-chief from 1921–1925. He was also American editor of *Mind* from 1894–1920.

Among his works are the following: *An Outline of Psychology,* 1896; *A Primer of Psychology,* 1898; *Experimental Psychology,* 1901-05; *Elementary Psychology of Feeling and Attention,* 1908; *Experimental Psychology of the Thought-Process,* 1909; *Textbook of Psychology,* 1910; and *A Beginner's Psychology,* 1915. In 1917 his former students and colleagues published a commemorative volume in the *Psychological Studies* in honor of the completion of his twenty-fifth year with Cornell University.

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Also the Emergence of Matter. ALFRED H. LLOYD.

Book Reviews. Journals and New Books. Notes and News.

Volume XXIV. No. 13. June 23, 1927.

Rignano's Hypothesis of a Vital Energy and the Prerequisites of a Sound Theory of Life. F. S. C. NORTHROP.

Book Reviews. Journals and New Books. Notes and News.

Volume XXIV. No. 14. July 7, 1927.

The Milesian Background of our Scientific Ontology. HAROLD CHAPMAN BROWN.

A Phenomenological Interpretation of Physico-Chemical Configurations and Conscious Structures (I). OLIVER L. REISER.

Book Reviews. Journals and New Books. Notes and News.

Volume XXIV. No. 15. July 21, 1927.

The Rôle of Dogma in Philosophy. W. H. SHELDON.

A Phenomenological Interpretation of Physico-Chemical Configurations and Conscious Structures (II). OLIVER L. REISER.

Book Reviews. Journals and New Books. Notes and News.

Volume XXIV. No. 16. August 4, 1927.

The Irrationality of *the Irrational.* SIDNEY HOOK.

William James and the Will to Believe. F. C. S. SCHILLER.

Book Reviews. Journals and New Books. Notes and News.

Volume XXIV. No. 17. August 18, 1927.

An Empirical Account of Appearance. JOHN DEWEY.

Moral Freedom. M. R. GABBERT.

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American Journal of Psychology.—Ithaca, N. Y.; Cornell University.
Subscription $6.50. 624 pages annually. Edited by E. B. Titchener.
Quarterly. General and experimental psychology. Founded 1887.

Pedagogical Seminary and Journal of Genetic Psychology.—Worcester, Mass.; Clark University.
Subscription $7.00. 700 pages annually. Edited by Carl Murchison and international co-operating board. [1891.
Quarterly. Child behavior, differential and genetic psychology. Founded

Genetic Psychology Monographs—Worcester, Mass.: Clark University.
Subscription $7.00. 600 pages annually. Edited by Carl Murchison and an international coöperating board.
Bi-monthly from January 1926. Each number one complete research. Child behavior, differential and genetic psychology. Founded 1925.

Psychological Review.—Princeton, N. J.; Psychological Review Company.
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Bi-monthly. General. Founded 1894. Edited by Howard C. Warren and John B. Watson.

Psychological Bulletin.—Princeton, N. J.; Psychological Review Company.
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Psychological Monographs.—Princeton, N. J.; Psychological Review Company.
Subscription $6.00 per volume. 500 pages. Founded 1895. Edited by Shepherd I. Franz.
Published without fixed dates, each issue one or more researches.

Psychological Index.—Princeton, N. J.; Psychological Review Company.
Subscription $2.00. 200 pages. Founded 1895. Edited by W. S. Hunter.
An annual bibliography of pyschology literature.

Archives of Psychology.—Sub-Station 84, New York; Archives of Psychology.
Subscription $5.00. 500 pages per volume. Founded 1906. Edited by R. S. Woodworth.
Published without fixed dates, each number a single experimental study.

Journal of Abnormal Psychology and Social Psychology.—Albany, N. Y.
Subscription $5.00. Boyd Printing and Publishing Co. Edited by Morton Prince in co-operation with Floyd H. Allport.
Quarterly. 432 pages annually. Founded 1906. Abnormal and social.

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Training School Bulletin.—Vineland, N. J.; The Training School.
Subscription $1.00. 160 pages annually. Edited by E. R. Johnstone. Founded 1904.
Monthly (10 numbers). Psychology and training of defectives.

Comparative Psychology Monographs.—Baltimore; Williams & Wilkins Co.
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Psychoanalytic Review.—Washington, D. C.; 3617 Tenth Street, N. W.
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Quarterly. Founded 1913. Edited by W. A. White and S. E. Jelliffe.

Journal of Experimental Psychology.—Princeton, N. J.
Psychological Review Company. 480 pages annually. Experimental.
Subscription $5.00. Founded 1916. Bi-monthly. Edited by Madison Bentley.

Journal of Applied Psychology.—Worcester, Mass.; Florence Chandler.
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Quarterly. Edited by James P. Porter and William F. Book.

Journal of Comparative Psychology.—Baltimore; Williams & Wilkins Co.
Subscription $5.00. 500 pages annually. Founded 1921.
Bi-monthly. Edited by Knight Dunlap and Robert M. Yerkes. J.P.

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Subscription $6.00. 600 pages annually. Edited by W. S. Hunter.
Monthly. Abstracts of psychological literature. Founded 1927.